

HIGHS.

Numbers I and II began in the Lake Superior region, moved a little south of east, and were last seen on or near the south Atlantic Coast. VII began to the north of Montana, and was last noted over Lake Superior. The remaining highs separated from the permanent high in the Pacific. There was a singular motion, first northward up the Pacific Coast and then east and southeast toward the Atlantic.

LOWS.

Of the lows, VI and VIII began off the north Pacific Coast; II, VII, IX, and XI north of Montana in the sub-permanent low in that region. IV and V began near Lake Superior, III in Nevada, I in North Carolina, and X off the middle Atlantic Coast. The general path was to the north of the United States and across the Lakes.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.										
I.....	1, a. m.	49	93	7, a. m.	37	83	2,000	6.0	334	13.9
II.....	5, a. m.	50	86	10, a. m.	33	73	1,660	5.0	332	13.8
III.....	5, a. m.	36	123	20, a. m.	38	73	5,330	15.0	355	14.8
IV.....	15, p. m.	34	121	24, p. m.	48	60	5,540	9.0	616	25.7
V.....	20, p. m.	47	123	28, a. m.	31	81	4,820	7.5	642	26.8
VI.....	24, a. m.	41	126	29, p. m.	33	100	3,280	5.5	596	24.8
VII.....	28, a. m.	52	113	31, p. m.	50	90	1,230	3.5	381	15.9
Total.....							23,960	51.5	3,256	
Mean of 7 paths.....							3,428	7.4	465	19.4
Mean of 51.5 days.....									465	19.4
Low areas.										
I.....	1, a. m.	36	82	6, a. m.	36	74	1,660	5.0	332	13.9
II.....	2, p. m.	55	111	5, a. m.	48	97	1,030	2.5	418	17.1
III.....	4, p. m.	42	117	10, p. m.	47	75	2,890	6.0	481	20.0
IV.....	10, a. m.	46	97	12, p. m.	48	77	1,420	2.5	574	23.9
V.....	12, p. m.	47	91	15, a. m.	49	68	1,230	2.5	514	21.4
VI.....	12, p. m.	48	128	17, p. m.	49	106	2,110	5.0	422	17.6
VII.....	18, p. m.	52	108	22, p. m.	45	61	2,800	4.0	700	29.2
VIII.....	19, p. m.	48	136	25, p. m.	44	67	3,220	6.0	536	22.3
IX.....	23, p. m.	53	119	28, p. m.	37	88	2,790	5.0	557	23.2
X.....	27, a. m.	41	69	29, p. m.	49	71	860	2.5	346	14.4
XI.....	27, p. m.	53	114	31, p. m.	51	68	2,220	4.0	556	22.2
Total.....							22,920	45.0	5,431	
Mean of 11 paths.....							2,026	4.1	494	20.6
Mean of 45 days.....									493	20.5

LOCAL STORMS.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

No severe tornado occurred within the United States during April and May, 1897, and there was an absence of minor tornadoes and violent thunderstorms that stands in marked contrast to the record of the same months in 1896. May, 1897, was unusually free from violent atmospheric disturbances.

March storms not heretofore reported: March 18, Texas, Tarrant County, 8:20 p. m., central time: no funnel, whirl, counter clock-wise, moved from southwest to northeast, no fatalities, property loss small.

March 31.—Arkansas: First observed near Orlando, Cleveland County, about 7 miles southeast of New Edinburgh, Ark.; path $\frac{1}{4}$ to $\frac{1}{2}$ mile wide; moved northeast. Observed again, near Star City, Lincoln County, and at Grady about 13 miles northeast of the latter. In all 7 persons, colored, were killed and probably a larger number injured. The path of the storm varied in width, and the length is not known. Property loss not large, probably not over \$10,000, aside from the loss to crops and standing timber.

A minor tornado was observed near Tuckerman, Jackson County, about 3:00 p. m. of the same date. No casualties and but small property loss.

April 1.—Missouri: Heavy rains and in places severe hail storms occurred.

3d.—Kansas: Topeka, 1 p. m., central time: a small funnel cloud formed over the corporate limits of Topeka and moved slowly northward, a little above the housetops. The damage was confined principally to chimneys and roofs. The funnel cloud was not more than 40 feet wide and at no time descended to the ground. Pedestrians were warned of its approach by a buzzing noise and had abundant opportunity to get out of the way. The funnel cloud was very black and the whirling was plainly visible, but no wind effects were noticed, except in the immediate track of the funnel.

7th.—Texas: Severe rain and hail storms visited the northern part of the State.

8th.—Indiana: Heavy rain and snow interrupted telephonic and telegraphic communication. Alabama and Georgia: Severe local storms occurred in Albany, Folkston, and Valdosta, Ga., and Ozark, Ala.; one life was lost by falling timbers at the last-named place.

19th.—Illinois and Michigan: High winds and gales prevailed over Lake Michigan and the adjacent territory; 5 persons were injured in Chicago by the falling of signs, derricks, etc.

22d.—Kansas: Four miles north of McFarland, Wabaunsee County, 8:45 p. m., central time: 1 killed, 7 injured; property loss about \$2,000; path from 50 to 200 feet wide, and 15 miles long; moved a little east of north. One mile west of Newton, 10:00 p. m., central time: no fatalities, 3 injured, property loss about \$2,000: moved a little east of north; path 150 feet wide and 12 miles long; destruction not continuous over the entire length.

23d.—Iowa: Anamosa, 8:50 p. m., central time: no casualties, property loss under \$5,000; path 300 feet wide, 5 miles long; moved a little east of north.

24th.—Michigan: Omer, Arenac County, 5:30 p. m., central time: 3 injured; property loss about \$4,800; path about 40 feet wide and a half mile long. Mr. C. F. Schneider, Section Director of the Michigan Climate and Crop Service, makes the following report upon the meteorological conditions on the day of the tornado:

The morning at Omer was clear and warm with a fresh southeast wind; toward noon the sky began to cloud over rapidly and the wind to increase in force. During the afternoon the clouds lowered and began to assume a threatening appearance, and the southeast wind increased to a gale of about 30 miles per hour. By 5:00 p. m. the sky was very dark and the wind had become strong enough to loosen signs and boards, and it had begun to shift to the south-southeast. At this time a violent thunderstorm set in, the thunder and lightning being continuous. The thunderstorm moved from the southwest to the northeast, and in advance of the tornado. About 5:15 p. m. a light sprinkle of rain fell for a few minutes, and this was followed by a light fall of small, opaque hailstones. During the half hour from 5:00 to 5:30 p. m., the wind continued to blow a gale from the south-southeast, and this wind was very warm and somewhat suffocating. At 5:30 p. m. (as near as can be determined) the tornado cloud suddenly made its appearance from the southwest.

This tornado cloud was typical in form, being described by such citizens as saw it, as "balloon shaped," or, as text books speak of such phenomena, "funnel shaped." It was about 40 feet high, its top having a steady forward movement, but the lower part of it, which corresponds to the basket or car of a balloon, had an unsteady motion, moving from side to side, and in advance, and sometimes in the rear of the body of the cloud. The whole cloud had a wavy horizontal movement, sometimes being nearly in contact with the earth, and then lifting up for some distance. It was accompanied by a peculiar roar.

May 8th.—Kansas: One mile west of Ulysses, 3 p. m., central time: no casualties; one building destroyed; path 100 yards wide, $\frac{1}{2}$ mile long.

May 9th.—Arkansas: Corning, 5 p. m., central time: no casualties; property loss about \$200; width of path 200 to 300 yards, length, 2 miles; moved northeast.

TEMPERATURE OF THE AIR.

[In degrees Fahrenheit.]

Both the mean temperatures and the departures from the normal are given in Table I for the regular stations of the

Weather Bureau, which also gives the height of the thermometers above the ground at each station. The mean temperature is given for each station in Table II, for voluntary observers.

The *monthly mean temperatures* published in Table I, for the regular stations of the Weather Bureau, are the simple means of all the daily maxima and minima; for voluntary stations a variety of methods of computation is necessarily allowed, as shown by the notes appended to Table II.

The *regular diurnal period* in temperature is shown by the hourly means given in Table V for 29 stations selected out of 82 that maintain continuous thermograph records.

The *distribution of the observed monthly mean temperature* of the air over the United States and Canada is shown by the dotted isotherms on Chart IV; the lines are drawn over the Rocky Mountain Plateau region, although the temperatures have not been reduced to sea level, and the isotherms, therefore, relate to the average surface of the country occupied by our observers; such isotherms are controlled largely by the local topography, and should be drawn and studied in connection with a contour map.

The *highest mean temperatures* were: In the United States, Yuma, 80.4; Phoenix, 79.5; Key West, 77.8; Corpus Christi, 75.8. In Canada, Bermuda, 70.0; Spences Bridge, 61.5; Battleford and Swift Current, 56.9; Calgary, 55.8; Edmonton, 55.4. The lowest were: In the United States, Sault Ste. Marie, 45.8; Marquette, 47.6; Eastport, 46.2; Portland, Me., 46.6; Alpena, 48.6. In Canada, Father Point, 42.8; White River, 45.6; Port Arthur, 45.8; Sydney, 47.2; St. Johns, N. F., 47.8.

As compared with the normal for May the mean temperature for the current month was in excess over the Plateau Region, the northern and the Pacific slopes, the Canadian Northwest Territories and Maritime Provinces. It was deficient in the Mississippi Valley, Atlantic States, and the Lake Region.

The greatest excesses were: In the United States, Havre, 7.3; Miles City, 7.1; Helena and Idaho Falls, 7.0; Winnemucca, 6.9; Rapid City, 6.7. In Canada, Swift Current, 5.9; Edmonton, 5.8; Calgary, 4.8; Qu'Appelle, 4.2. The largest deficits were: Cincinnati, 5.0; Parkersburg and Indianapolis, 4.9; Pittsburg and Louisville, 4.5; Lexington, 4.0. In Canada, Quebec, Montreal, and Toronto, 1.4; Saugeen, 1.2; Kingston, 0.9.

Considered by districts the mean temperatures of the current month show departures from the normal as given in Table I. The greatest positive departures were: Northern Slope, 5.6; middle Plateau, 5.2; northern Plateau, 5.0. The greatest negative departures were: South Atlantic, 1.5; Florida Peninsula and East Gulf, 1.6; Ohio Valley and Tennessee, 3.9.

In Canada.—Prof. R. F. Stupart says:

In British Columbia and the Northwest Territories the mean temperature of the month was very much above average, the greatest excess being between 9° and 12° in southern Alberta. The line of no departure passes through eastern Manitoba, Port Arthur, and White River. Nearly all Ontario shows a mean temperature ranging from average to 3° below. Quebec stations all show about 1° degree below average. In the Maritime Provinces the departure ranged from zero to plus 3°.

The *years of highest and lowest mean temperatures* for May are shown in Table I of the REVIEW for May, 1894. The mean temperature for the current month was the highest on record at: Red Bluff, 72.6; Fresno, 71.7; Sacramento, 67.0; Walla Walla, 65.3; Salt Lake City, 63.4; Spokane, 62.4; Winnemucca, 60.8; Havre, 60.6; Helena, 60.0; Rapid City, 59.8; Carson City, 59.4; Idaho Falls, 58.6; Baker City, 58.2. It was the lowest on record at: Parkersburg, 58.6; Indianapolis, 58.8; Lexington, 59.4; Cincinnati, 59.5; Louisville, 61.6; Nashville, 64.4.

The *maximum and minimum temperatures* of the current

month are given in Table I. The highest maxima were: 104, Phoenix (28th); 102, Yuma (28th); 100, Walla Walla (29th); 99, Fresno (20th); 98, Red Bluff (19th); 95, Spokane (29th). The lowest maxima were: 64, Eastport (5th); 65, Woods Hole (18th); 66, Nantucket (frequently); 67, San Diego (frequently) and Tatoosh Island (13th); 68, Block Island (18th); 70, Eureka (11th) and Narragansett Pier (18th). The highest minima were: 70, Key West (8th); 62, Galveston (1st); 60, Corpus Christi (2d); 59, Port Eads (frequently). The lowest minima were: 24, Northfield (8th); 25, Williston (13th); 26, Moorhead (24th); 27, Huron (24th), Idaho Falls (8th); 28, Bismarck and North Platte (14th), Cheyenne (9th); 29, Carson City and Winnemucca (8th), Lander (9th).

The *years of highest maximum and lowest minimum temperatures* for May are given in the last four columns of Table I of the REVIEW for May, 1896. During the current month the maximum temperatures were equal to or above the highest on record at: Walla Walla, 100; Spokane, 95; Idaho Falls, 89; Baker City, 88; Fort Canby, 85. The minimum temperatures were equal to or below the lowest on record at: Cincinnati and Columbus, Ohio, 33.

The *greatest daily range of temperature and the data for computing the extreme and mean monthly ranges* are given for each of the regular Weather Bureau stations in Table I. The largest values of the greatest daily ranges were: Moorhead, 48; Williston, 45; Huron and Havre, 44; Bismarck and Carson City, 43. The smallest values were: San Diego, 11; Galveston, 13; Key West, 14; Nantucket, 15; Tatoosh Island, 18; Block Island and Hatteras, 19.

Among the *extreme monthly ranges* the largest were: Williston, 65; Moorhead, 64; Bismarck and Idaho Falls, 62; Winnemucca, 61; Walla Walla and Huron, 60. The smallest values were: Key West, 16; San Diego, 17; Galveston, 21; Woods Hole, 23; Tatoosh Island, 24; Nantucket, 25; Block Island, Hatteras, Port Eads, and Corpus Christi, 26.

Accumulated monthly departures from normal temperatures from January 1 to the end of the current month are given in the second column of the following table, and the average departures are given in the third column for comparison with the departures of current conditions of vegetation from the normal condition.

Districts.	Accumulated departures.		Districts.	Accumulated departures.	
	Total.	Average.		Total.	Average.
	°	°		°	°
New England	+ 5.6	+ 1.1	South Atlantic.....	- 0.5	- 0.1
Middle Atlantic.....	+ 2.4	+ 0.5	East Gulf.....	- 1.0	- 0.3
Florida Peninsula.....	+ 0.9	+ 0.2	Ohio Valley and Tenn...	- 1.5	- 0.3
West Gulf.....	+ 4.5	+ 0.9	North Dakota.....	- 3.9	- 0.8
Lower Lake ..	+ 3.8	+ 0.8	Southern Slope.....	- 0.8	- 0.2
Upper Lake ..	+ 3.3	+ 1.7	Southern Plateau	- 3.4	- 0.7
Upper Mississippi Valley..	+ 1.5	+ 0.3	Middle Plateau	- 4.1	- 0.8
Missouri Valley	+ 0.9	+ 0.2	Middle Pacific.....	- 3.5	- 0.5
Northern Slope.....	+ 1.0	+ 0.2	South Pacific.....	- 2.2	- 0.4
Middle Slope.....	+ 2.3	+ 0.5			
Northern Plateau.....	+ 3.5	+ 1.9			
North Pacific.....	+ 0.2	+ 0.0			

MOISTURE.

The *quantity of moisture* in the atmosphere at any time may be expressed by the weight of the vapor coexisting with the air contained in a cubic foot of space, or by the tension or pressure of the vapor, or by the temperature of the dew-point. The mean dew-point for each station of the Weather Bureau, as deduced from observations made at 8 a. m. and 8 p. m., daily, is given in Table I.

The *rate of evaporation* from a special surface of water on muslin at any moment determines the temperature of the wet-bulb thermometer. The mean wet-bulb temperature is now published in Table I; it is always intermediate, and